



## Cold Weather Hazards

### Winter Conditions at the North Slope of Alaska

The North Slope of Alaska is north of the Arctic Circle at north latitudes ranging from 69 to 72 degrees. Barrow, the largest town on the North Slope (pop. 4000), is the site of a National Weather Service Station, which has been active for several decades, so the climatology of the Alaska arctic coastal region as represented by Barrow is relatively well known. The North Slope is covered with ice and snow typically nine months of the year (September-May). During part of November, all of December, and most of January, the sun does not come above the horizon; this is what is referred to as the "polar night." Particularly during this period, quite low temperatures routinely occur although severe winter weather can be encountered anytime between October and May.

The low temperature record at Barrow is 57 degrees F below zero. Lower temperatures very likely occur on the coastal plain farther away from the coast. Temperatures in the range of 25 to 45 degrees F below zero are common in winter. The most notable cold weather safety threat on the arctic coastal plain, however, is that these low temperatures occur in combination with moderate to high winds. Typical wind chill factors are 60 to 80 degrees F below zero. **With these wind chills, exposed flesh freezes in one to two minutes.** A wind chill chart is included on the following page. Excursions to triple digit wind chills on the Alaskan North Slope are not unusual.

Appropriate clothing, equipment and procedures are necessary to assure outdoor safety under these conditions. When people move around within the populated areas of Barrow, these conditions impose surprisingly minor burdens. In such areas, exposure is limited to minutes, and the array of buildings cuts the wind at ground level so that the actual wind chill is less severe than in the surrounding countryside. The major danger occurs when working outdoors on the tundra or sea ice for sustained periods. Also remember that wind chill factors can easily drop to triple digits below zero when travelling on a snow machine at 30 mph.



## Wind Chill Chart



		Temperature (°F)																		
		Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Wind (mph)	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63	
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72	
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77	
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81	
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84	
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87	
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89	
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91	
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93	
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95	
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97	
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98	

Frostbite Times

30 minutes 10 minutes 5 minutes

**Wind Chill (°F) = 35.74 + 0.6215T - 35.75(V<sup>0.16</sup>) + 0.4275T(V<sup>0.16</sup>)**  
Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

### Protective Clothing

The appropriate protective clothing and equipment have been identified through published sources and lengthy conversations with local Barrow agencies, contractors and hunters, including North Slope Borough Search and Rescue, North Slope Borough Wildlife Management Department, and the ARM North Slope liaison and support contractor (UIC Science Division).

**Visitors to the NSA site must supply their own cold-weather clothing.** Appropriate winter clothing includes the following:

*The under layer – to keep your skin dry*

The under layer of clothing should be of synthetic fabrics with good moisture wicking ability like polypropylene, wool blends and silk. Do not use cotton as an under layer fabric as it has poor wicking and insulating properties when wet. Under layer items include the following:

- Thermal underwear
- Sock liners
- Glove liners

***The clothing layer – the insulating layer to keep you warm***

The middle layer fabrics trap air in their fibers and provide insulation from the cold. Polar fleece fabrics are particularly well suited for the clothing layer. The fabric is soft, absorbs little moisture, insulates when wet, and dries very quickly. Useful middle layer garments include the following:

- Turtle necks/sweaters
- Polar fleece or other insulating jacket/vest
- Polar fleece or other insulated pants
- Socks
- Hat
- Neck gaiter
- Gloves

***The outer layer - to protect you from rain, snow, and wind***

The outer layer should be constructed of tightly woven fabrics to give protection against the wind. Waterproof qualities are less important on the North Slope in winter since liquid water is seldom present. Outer layer garments include the following:

- Hooded parka
- Wind pants
- Insulated boots
- Goggles

- Face mask, balaclava

Exactly what clothing is needed at any given time is a judgment call depending upon the prevailing and forecast weather. Ironically, overheating is a significant threat. Overheating caused by overexertion leads to perspiration, which in turn degrades the insulating value of clothing. Upon cessation of exertion, overheating easily turns to hypothermia. Consequently, exertion and protective clothing need to be carefully balanced, and adjusted as needed to minimize or preferably prevent perspiration. If working away from established NSA/AAO sites, additional equipment may include first aid and emergency survival supplies, lighting, radio or cellular telephone communications to summon help, and provisions for emergency shelter. Remember to carry phones and batteries in inside pockets. A frozen battery will not work.

Appropriate procedures at all ARM/NSA work locations include keeping a designated responsible individual informed as to work plans involving sustained outdoor work, contingency planning in the event that a means of transportation fail (snow machine, all terrain vehicle, 4 WD truck etc.), and avoidance of white-out (extreme low visibility) conditions that favor disorientation.

Extended work activities by ARM personnel at remote locations during extreme cold conditions require survival training. Contact the Site Manager for more information for work planning and training for these anticipated work conditions.

### **First aid for frostbite**

When exposed to very cold temperatures, the skin and underlying tissues may freeze, resulting in frostbite. The areas most likely to be affected are the hands, feet, nose, and ears. Frostbite is distinguishable by the hard, pale, and cold quality of the skin that has been exposed to the cold. As the area thaws, the flesh becomes red and painful. If your fingers, ears, or other areas are frostbitten, get out of the cold. Warm your hands by tucking them into your armpits; if your nose, ears, or face are frostbitten, warm the area by covering it with dry, gloved hands. Do not rub the affected area.

If numbness remains during warming, seek professional medical care immediately. If you are unable to get immediate emergency assistance, warm severely frostbitten hands or feet in warm--not hot--water. (The water should be between 100 and 105 degrees F.)

When a reddish color returns to the frostbitten skin, take it out of the warm water and pat it dry gently. Take care not to break any blisters that may have formed and do not rub the skin. Cover the skin with a loose bandage and seek medical help immediately. If the feet or legs are frostbitten, do not attempt to walk unless walking is necessary for survival.

### **ARM/NSA Cold-weather Clothing Policy**

**It is the responsibility of each site visitor to provide his/her own cold-weather clothing for use at the site.** Frequent visitors to the site store their clothing in duffel bags in various duplex closets. **This clothing is not for visitor use.** An assortment of spare boots, gloves, wind pants, and other miscellaneous items may be available at the NSA duplex at any given time, however, one should not rely on the availability of these items for routine use. Cold-weather gear can be purchased from a variety of retail suppliers. See [www.rei.com](http://www.rei.com) or [www.llbean.com](http://www.llbean.com) or other similar retail outlets for web-based catalog sales of clothing. A very limited selection of cold-weather gear is also available locally in Barrow at the supermarket/department store operated by Alaska Commercial.